

Jan. 18, 1966

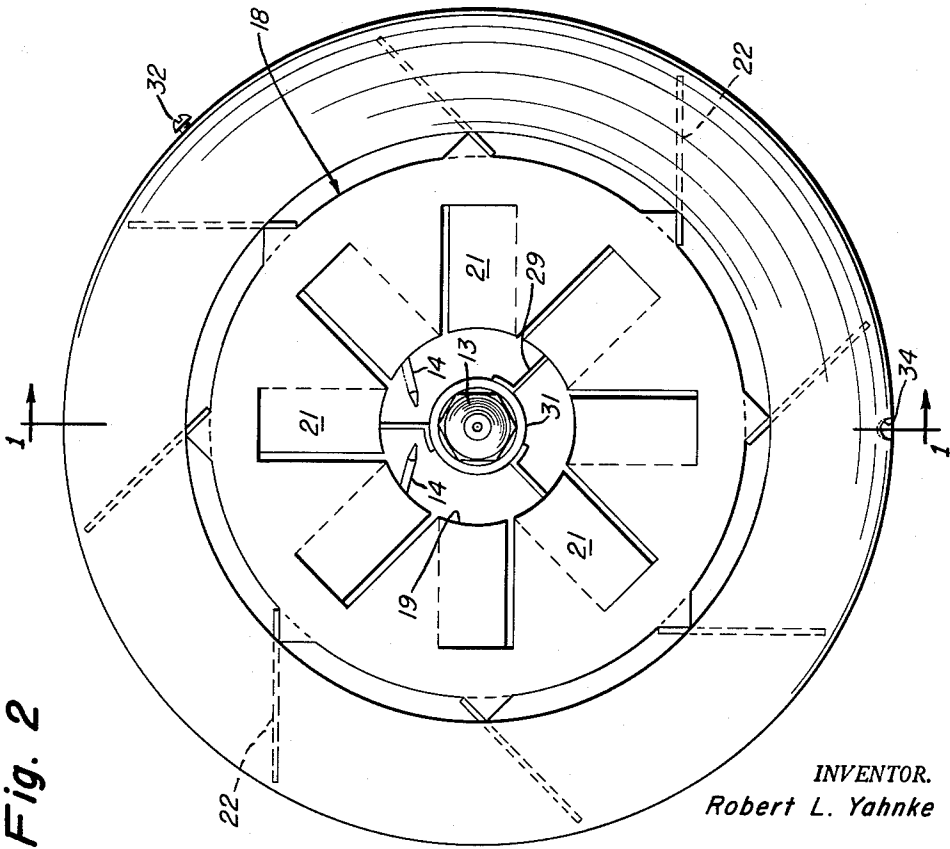
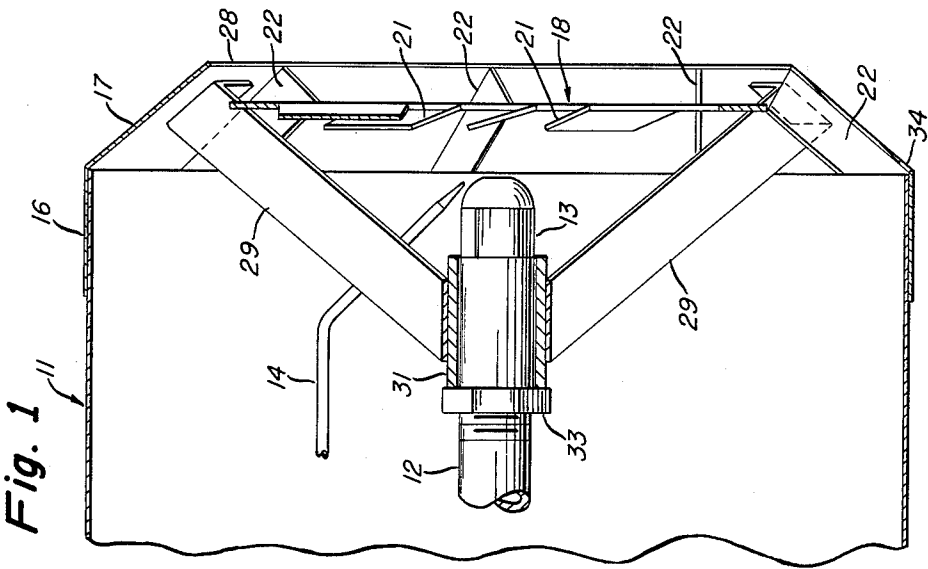
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3,229,915

COMBUSTION AIR DIRECTING APPARATUS

Filed May 3, 1963

3 Sheets-Sheet 1



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Fig. 3

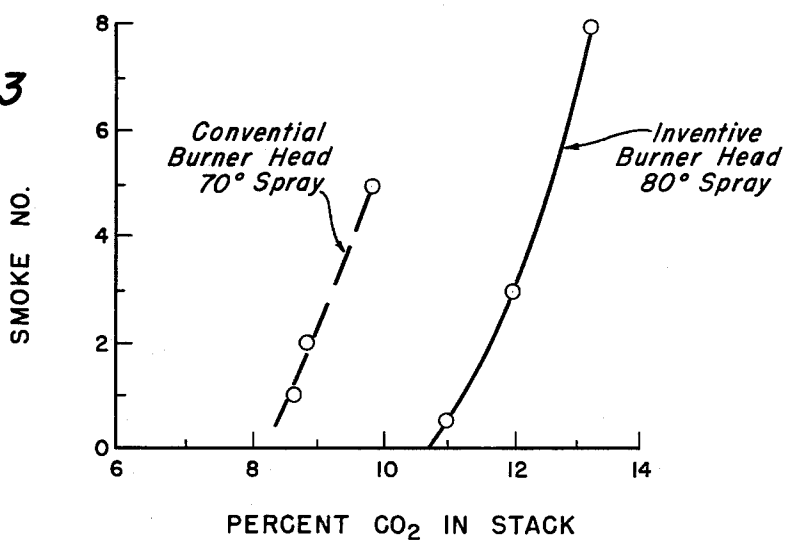
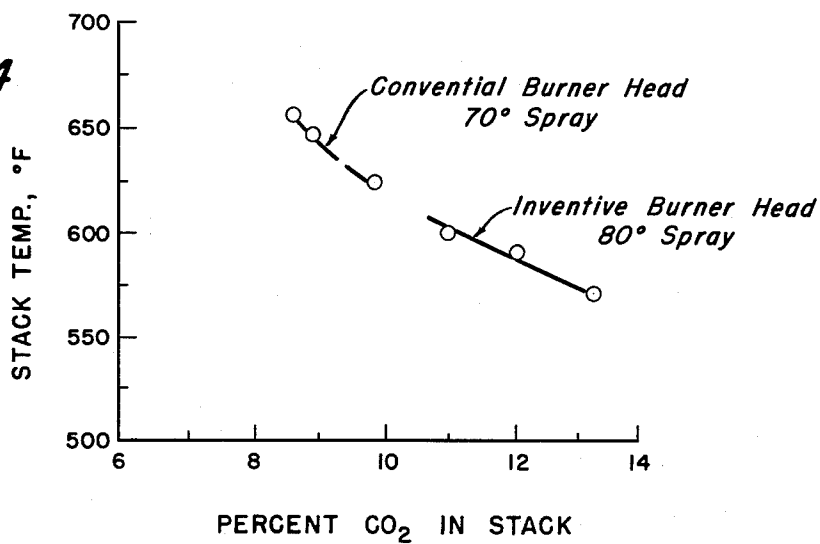


Fig. 4



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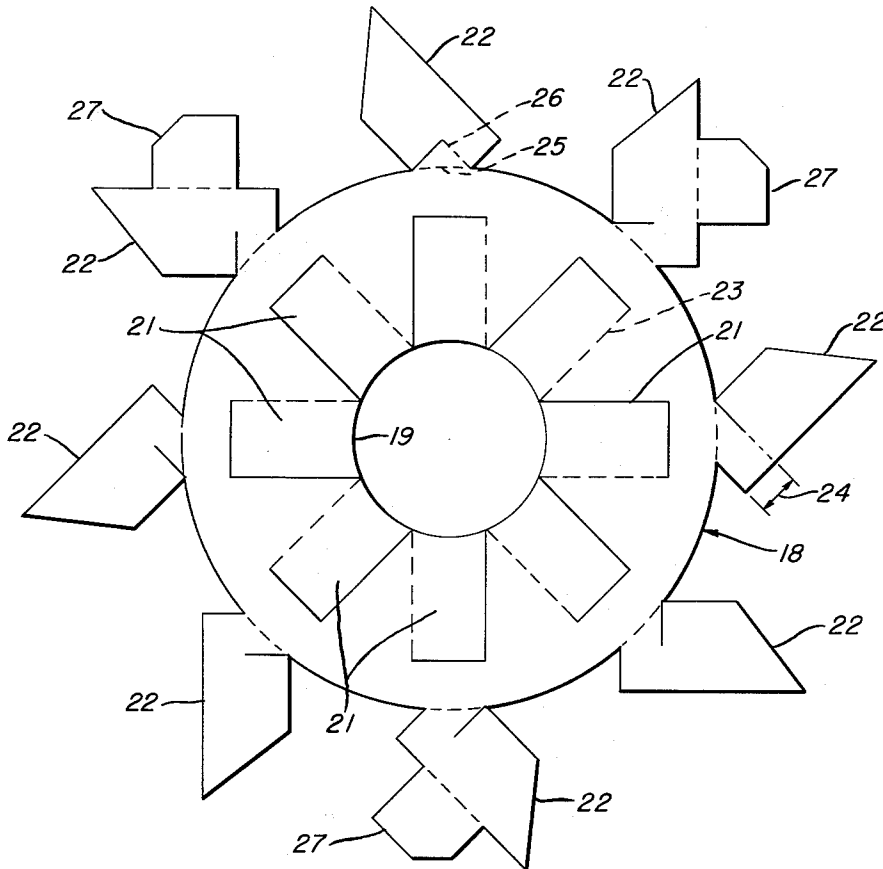
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Fig. 5



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COMBUSTION AIR DIRECTING APPARATUS
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5 Claims. (Cl. 239—430)

This invention relates to improved burner heads for gun-type oil burners, and more particularly concerns the provision of a burner head which increases the combustion efficiency of such oil burners.

Most oil burners for home heating installation are of the gun type, in which combustion air is blown into the furnace via a cylindrical blast tube, and in which the oil is atomized by a high pressure nozzle positioned on the axis and at the end of the blast tube. In order to improve the mixing of air and atomized fuel as they leave the burner, and hence to improve the combustion characteristics and efficiency of the burner itself, it is conventional to employ various arrangements of baffles, vanes, and the like at the end of the blast tube.

I have found, unfortunately, that many of the devices alleged to improve oil burner performance are subject to serious disabilities, and not infrequently interfere with combustion to such an extent that burner performance is actually decreased.

An object of the present invention is to provide an apparatus for increasing the efficiency of gun-type oil burners which is simple to fabricate, easy to install, fool-proof in operation, and which significantly improves the combustion characteristics of such burners.

Another object is to provide an improved burner head with an integral means for positioning and supporting the oil nozzle.

A further object is to provide such burner head which is adaptable both with new and with existing gun-type burners.

Still another object is to provide a burner head which, unlike many now on the market, does not foster coking of the oil remaining in atomizing nozzles after oil flow has been terminated.

An overall object is to provide an improved burner head for gun-type oil burners which improves the flame pattern, reduces fuel oil consumption, minimizes smoke and soot formation, and otherwise improves burner and furnace performance.

Other and more particular objects will become apparent as the description of this invention proceeds.

Briefly, according to the invention, I provide an improved burner head for gun-type oil burners, in which an extension of the blast tube cooperates with a flame-holding disk, with air-directing louvers formed integral with the disk, and with a plurality of vanes, all fabricated of thin metal, to stabilize the flame and to direct the combustion air in an optimal pattern for mixing with the atomized oil and for combustion therewith. By fabricating the flame-holding disk, the louvers, and, advantageously, the air-directing vanes of one piece of metal, the inventive apparatus may be made at low cost, while simultaneously avoiding difficulties in fabrication and use. [A special bracket is employed to maintain the atomizing nozzle coaxial with the blast tube.] By disposing both this bracket and the air-directing vanes in planes substantially parallel (i.e., within about 5–10°) to the axis of the blast tube, there is substantially no interference with the normal flow of air through the burner.

Finally, by employing thin metal, for example stainless steel sheeting of about 0.03–0.06 inch thick, for its

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components, the head itself possesses low heat capacity, and hence exhibits little tendency to radiate heat from the burner head back to the atomizing nozzle and thereby thermally coke oil remaining in or on the nozzle after combustion has been terminated.

Other objects, features, and advantages of the invention will be apparent from the ensuing description which is to be read in conjunction with the attached drawings wherein:

FIGURE 1 depicts an elevation view, in section, of the inventive burner head as it is installed on a gun-type oil burner;

FIGURE 2 is an end view of the installed burner head; FIGURE 3 presents a comparison of the relationship between smoke number and carbon dioxide content of stack gases with a conventional burner head and with the inventive head;

FIGURE 4 compares stack temperature and carbon dioxide content with a conventional burner head and with the burner head of the invention; and,

FIGURE 5 is a typical sheet metal blank, as may be used in fabricating the inventive apparatus.

Turning first to FIGURE 1, my burner head is shown as it is conventionally installed on a gun-type burner having an air blast tube 11, an axial fuel supply conduit 12, and an oil atomizing nozzle 13. Nozzle 13 is connected to fuel supply conduit 12 by nozzle adapter 33. A pair of ignition electrodes 14 (better shown in FIGURE 2) provide electrical ignition of the atomized fuel oil stream.

The improved burner head comprises several sections which are either fabricated of a common piece of metal, or are welded or otherwise joined into a unitary structure. As shown in FIGURE 1, the new burner head comprises a blast tube extension having a cylindrical portion 16 which is adapted for attachment to blast tube 11, and a constricting frustoconical portion 17 extending beyond the blast tube 11 and the nozzle 13.

Diverting momentarily to FIGURE 2, a flame-holding disk 18 is disposed concentric with blast tube 11 and its extension, 16, 17, and is round or circular in shape, with a concentric port or hole 19 at its center through which atomized oil from nozzle 13 is discharged.

Disk 18 is also provided with a plurality, advantageously eight, of radially extending louvers 21, which occupy a major portion of the inner area of disk 18. Louvers 21 are generally rectangular in shape, and are bent at a slight angle with respect to the surface of disk 18 so that air passing through these louvers 21 is directed along the surface of disk 18. This prevents contact between disk 18 and the flame, while simultaneously permitting disk 18 to serve as a flame holder; were louvers 21 to be replaced by simple perforations or by slots which form an acute angle with the front of disk 18, the flame-holding function of this disk would be affected deleteriously.

Returning to FIGURE 1, disk 18 is shown installed within the constricting frustoconical portion 17, approximately intermediate the end of nozzle 13 and the end of portion 17. Louvers 21 are bent inwardly, in a direction toward nozzle 13.

The largest proportion of the combustion air is fed through the annulus defined by constricting frustoconical portion 17 and disk 18. In order to provide optimal mixing of this air with the atomized stream or spray of fuel oil from nozzle 13, a plurality—again advantageously eight—of air-directing vanes 22 is provided in the annu-

lus. Vanes 22 each lie in planes parallel to but non-coincident with, the axis of blast tube 11 so as to provide minimal impedance to the flow of air through blast tube 11, and thus to maximize the efficiency of the air blower, not shown. Vanes 22 are generally trapezoidal in shape, and are shown most clearly in FIGURE 5.

Turning now to FIGURES 3 and 4, the inventive burner head is compared with a conventional commercially-obtainable burner head, using the criteria of smoke number as a function of carbon dioxide content of the stack gas, and stack temperature as a function of carbon dioxide content in the stack. Smoke number, sometimes referred to as smoke spot number, is obtained by means of an empirical test. See ASTM Standards, 1964, Part 17, pp. 659-662, "Tentative Method of Test for Smoke Density in the Flue Gases from Distillate Fuels," ASTM Designation: D 2156-63T. The conventional burner head, with a seventy-degree spray atomizing nozzle (manufacturer's recommendation for optimum performance), produces significantly more smoke at any given carbon dioxide content, and has a substantially higher stack temperature, both of which are indicative of inferior performance as compared with the inventive burner head.

Turning to FIGURE 5, a preferred sheet metal blank for the new burner head is shown. When used with a blast tube having an outer diameter of approximately four and one-quarter inches, disk 18 will have a diameter of two and three-fourths inches, while central port 19 will have a diameter of one inch. Louvers 21 are three-eighths inch wide by five-eighths inch long, and are bent back along dotted line 23 a distance of about one-sixteenth inch plus the thickness of the sheet metal.

Air directing vanes 22 are, in the example, fifteen-sixteenths inch long by seven-sixteenths inch wide, and distance 24 is three-sixteenths inch. Vanes 22 of the example are integral with the disk, and are bent back about forty degrees along line 25, and then bent up along line 26 so that the vanes 22 are vertical.

Some of the non-adjacent vanes 22 are provided with welding tabs 27, which are three-eighths inch long by seven-sixteenths inch wide, and have a five-thirtysecond inch bevel. These tabs are bent so as to conform with the frustoconical portion 17 (FIGURE 1) of the burner head, and constitute the means by which the assembly of disk, louvers 21, and vanes 22 are attached to the blast tube extension.

It is particularly noted that flame-holding disk 18, louvers 21, and air-directing vanes 22 are all fabricated of the same piece of sheet metal. Similarly, cylindrical portion 16 and constricting frustoconical portion 17 of the blast tube extension may be rolled or drawn from one piece of sheet metal; dimensions of cylindrical portion 16 are 4.25 inches inner diameter by three-fourths inch long, while the constricting frustoconical portion 17 is tapered inward fifty degrees and has an egress port 28 three inches wide.

Returning to FIGURE 1, a plurality—advantageously three—of brackets or arms 29 is provided which extend from constricting frustoconical portion 17 (to which they are attached) to a collar 31 disposed around atomizing nozzle 13. Arms 29 are welded in place. It is particularly important that arms 29 be in a plane substantially parallel to the axis of the blast tube so as to afford minimal interference with air flow patterns. Arms 29 serve both to maintain coaxiality of nozzle 13 with disk 18 and blast tube 11, and to space the discharge port of nozzle 13 the proper distance, e.g. 1/4" behind disk 18. Although shown in the drawing as having one arm 29 between electrodes 14, it is preferred that the assembly be rotated so that none of the arms are between electrodes.

The burner head may be attached to a blast tube by any

suitable technique, as for example by welding, crimping, or by the use of one or more lock screws 32.

It is also advisable to provide means for minimizing or preventing coke deposition in or on atomizing nozzle 13 notwithstanding the fact that sheet metal components of the new burner head exhibit less tendency to cause such coking than conventional cast iron or similar components. To prevent oil from accumulating along this bottom of the blast tube, a drip hole 34 may be provided at the bottom of constricting frustoconical portion 17, and, if desired, a solenoid valve may be installed in the fuel oil supply line, between the discharge of the fuel oil pump (not shown) and nozzle 13, which terminates oil flow immediately upon shutting off power to the pump. This prevents the pump from discharging low-pressure oil while the pump and fan motor is slowing down. It is this low-pressure oil which is most likely to trickle from nozzle 13 and form coke deposits.

Thus it is apparent that there has been provided, according to the invention, an improved apparatus for increasing the efficiency of gun-type oil burners. All of the objects of the invention have been fully satisfied.

While the invention has been described in conjunction with a specific embodiment thereof, it is manifest that many alternatives, modifications, and variations will be apparent to those skilled in the art in light of the foregoing description. Accordingly, it is intended to embrace all such alternatives, modifications, and variations as fall within the spirit and broad scope of the appended claims.

I claim:

1. An improved burner head for a gun-type oil burner having an air blast tube and an axial fuel supply conduit terminating in an oil-atomizing nozzle, comprising:

a blast tube extension having a cylindrical portion and a constricting frustoconical portion, said cylindrical portion being adapted for attachment to the blast tube, said frustoconical portion adapted to extend beyond said blast tube;

a flame-holding disk positioned within said frustoconical portion, said disk being provided with a circular port adapted to allow atomized oil flow therethrough, said port being concentric with the periphery of said disk, said blast tube extension and said disk being coaxial and separated;

louver means, said louver means being formed integral with said disk for directing a minor portion of the air along the surface of said disk which faces toward said constricting portion so as to prevent direct contact of said disk by flames;

a plurality of air-directing vanes disposed in the annular passage separating said disk and said blast tube extension, each of said vanes lying wholly within a plane parallel to the axis of said blast tube;

a collar adapted to fit around an oil spray nozzle within the blast tube;

and a plurality of arms, each lying in a plane parallel to the axis of the cylindrical portion, said arms connecting said collar with said frustoconical portion to maintain said collar concentric with said cylindrical portion and said disk;

said blast tube extension, said disk, said louver means, said vanes, and said arms all being of material possessing a low heat capacity, whereby radiation from said burner head to said nozzle is minimized after termination of combustion.

2. The burner head of claim 1 further characterized in having eight equally spaced louvers and eight equally spaced vanes.

3. The burner head of claim 1 further characterized in that said material possessing a low-heat capacity is sheet metal having a thickness of about 0.03-0.06 inch.

4. The burner head of claim 1 further characterized by having said vanes formed integral with said disk.

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5. The burner head of claim 1 further characterized in that at least some of said vanes are attached to said constricting frustoconical portion.

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